WHAT IS CLAIMED IS:

1. A method of detecting surface plasmon resonance comprising the steps of:

(a) focusing a beam of electromagnetic radiation on a layer of metallic material, upon which layer is optionally a sample material;

(b) detecting said beam of electromagnetic radiation reflected from said layer of metallic material with a differential position or intensity sensitive photo-detecting device;

(c) noting the intensity of the first A position or intensity signal and the intensity of the first B position or intensity signal produced by said differential position or intensity sensitive photo-detecting device;

(d) positioning said differential position or intensity sensitive photo-detecting device such that the surface plasmon resonance intensity minimum is near the center of the differential position or intensity sensitive photo-detecting device such that the difference in said A position or intensity signal and said B position or intensity signal is near zero; and

(e) detecting subsequent changes in the intensity distribution due to the surface plasmon resonance angular shift.

2. A method of detecting surface plasmon resonance in accordance with claim 1, wherein said differential position or intensity sensitive photo-detecting device is a bi-cell photodetector, wherein one cell produces said A position or intensity signal and the other cell produces said B position or intensity signal.

3. A method of detecting surface plasmon resonance in accordance with claim 1, wherein said differential position or intensity sensitive photo-detecting device is a mono-cell photodetector that produces both said A and B position or intensity signals by sampling intensity at alternate time points.

4. A method in accordance with claim 1 further comprising the step of amplifying the differential signal received from said differential position or intensity sensitive photo-detecting device.

5. A method in accordance with claim 4, wherein said amplifying the differential signal can be adjusted or varied.

6. A method in accordance with claim 4 further comprising the step of determining said differential signal, a sum signal, and a ratio of said differential signal to said sum signal.

7. A method in accordance with claim 6 where said amplifying a differential signal and determining said differential signal, a sum signal, and a ratio of the differential signal to the sum signal is done by an electronic unit.

8. A method in accordance with claim 6 further comprising the step of modulating/controlling the electrochemical potential of the layer of metallic material.

9. A method in accordance with claim 8 wherein said modulating the electrochemical potential of the layer of metallic material is done by at least one reference electrode and at least one counter electrode.

10. A method in accordance with claim 9, wherein said reference electrode(s) and counter electrode(s) are elements of a means of introducing onto said layer of metallic material a sample to be analyzed.

11. A method in accordance with claim 4, wherein said amplifying the differential signal can be done to the extent such that there is substantially no problem of saturation.

12. A method in accordance with claim 8 further comprising the step of detecting the SPR angle and the electrochemical current.

13. A method in accordance with claim 12, wherein said detecting the SPR angle and the electrochemical current is done by at least one lock-in amplifier.

14. A method in accordance with claim 8, wherein said detecting the SPR angle and the electrochemical current functions concurrently with the modulation of the electrochemical potential of the layer of metallic material.

15. A method in accordance with claim 1, further comprising the step of determining interfacial capacitance.

16. A sensor in accordance with claim 15, wherein said determining interfacial capacitance consists of simultaneously recording the DC and AC components of the electrochemical current.

17. A method in accordance with claim 15, further comprising the step of simultaneously recording the amplitude and phase of the differential signal.

18. A sensor comprising:

(a) a sensor body made of a material transparent to electromagnetic radiation;

(b) a layer of metallic material disposed over at least part of a first surface of said body;

(c) a means of introducing onto said layer of metallic material a sample to be analyzed;

(d) a source of a beam of electromagnetic radiation focused on said layer of metallic material; and,

(e) a differential position or intensity sensitive photo-detecting device of said beam of electromagnetic radiation reflected from said layer of metallic material, said differential position or intensity sensitive photo-detecting device positioned to receive said beam.

19. A sensor in accordance with claim 18, wherein said differential position or intensity sensitive photo-detecting device consists of at least one photo-cell.

20. A sensor in accordance with claim 18, wherein said differential position or intensity sensitive photo-detecting device consists of at least one photo-cell.

21. A sensor in accordance with claim 18, wherein said means for introducing onto said layer of metallic material a sample to be analyzed is a sample cell comprising:

(a) a sample cell body of a material that isolates said sample from ambient air;

(b) a window in said sample cell body of a material that is transparent to electromagnetic radiation; and,

(c) at least one port for introducing and removing said sample.

22. A sensor in accordance with claim 18 further comprising a means for amplifying a differential signal received from said differential position or intensity sensitive photo-detecting device.

23. A sensor in accordance with claim 22, wherein said means for amplifying a differential signal can be adjusted or varied.

24. A sensor in accordance with claim 22 further comprising a means for determining said differential signal, a sum signal, and a ratio of said differential signal to said sum signal.

25. A sensor in accordance with claim 24 where said means for amplifying a differential signal and means for determining said differential signal, a sum signal, and a ratio of the differential signal to the sum signal is an electronic unit.

26. A sensor in accordance with claim 24 further comprising a means for modulating/controlling the electrochemical potential of the layer of metallic material.

27. A sensor in accordance with claim 26 wherein said means for modulating the electrochemical potential of said layer of metallic material consists of at least one reference electrode and at least one counter electrode.

28. A sensor in accordance with claim 27, wherein said a means of introducing onto said layer of metallic material a sample to be analyzed includes said reference electrode(s) and counter electrode(s).

29. A sensor in accordance with claim 22, further comprising a means to bring said differential signal near zero prior to measurement such that the differential signal can be amplified to the extent such that there is substantially no problem of saturation.

30. A sensor in accordance with claim 29, wherein said means to bring the differential signal near zero prior to measurement consists of mounting said differential position or intensity sensitive photo-detecting device on a movable part that can positioned such that the differential signal that said differential position or intensity sensitive photo-detecting device detects is near zero prior to measurement.

31. A sensor in accordance with claim 18 further comprising a means for detecting the SPR angle and the electrochemical current.

32. A sensor in accordance with claim 31, wherein said means for detecting the SPR angle and the electrochemical current consists of at least one lock-in amplifier.

33. A sensor in accordance with claim 26, wherein said means for detecting the SPR angle and the electrochemical current functions concurrently with the modulation of the electrochemical potential of the layer of metallic material.

34. A sensor in accordance with claim 18, further comprising a means of determining interfacial capacitance.

35. A sensor in accordance with claim 34, wherein said means of determining interfacial capacitance consists of a means of simultaneously recording the DC and AC components of the electrochemical current.

36. A sensor in accordance with claim 33, further comprising a means of simultaneously recording the amplitude and phase of the differential signal.

37. A sensor in accordance with claims 18-36 which is less than 2 inches in one dimension.

38. The use of a sensor in accordance with claims 18-37 in biological, biochemical, or chemical testing.

39. A method of determining the surface plasmon resonance angle using a sensor in accordance with claims 18-37 comprising the steps of:

(a) determining the differential signal;

(b) determining the sum signal;

(c) determining a calibration curve;

(d) determining the ratio of the differential signal to the sum signal based on the calibration curve.